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THE CATEGORIES

By J. W. POWELL

In my volume entitled *Truth and Error* I employed deductive reasoning to demonstrate the constancy of speed in the ultimate particle. The method will be justified in this article.

Induction leads to the discovery of laws. The laws themselves may at first be imperfectly understood and improperly stated; often they require revision from time to time as new facts are discovered. When at last the law is fully known and correctly stated it becomes a self-evident proposition. Every finally developed law is an axiom. Laws are objective facts inherent in objective nature; the discovery of these laws is an act of mind which reconstructs them from nature. So-called laws often prove to be fallacies of judgment, and laws as first stated often require restatement, for laws are creations of the mind only for the mind and not for nature. The mental operation is a struggle for natural truths, and the human statement of a law must ultimately conform to the natural law.

The nature of deductive and inductive reasoning will be set forth in a subsequent contribution; here we must be content with the bare statement just made.

A categorical question is one that can be answered by simple affirmation or negation with a "yes" or "no" or a nod of the head. That a categorical question may be asked it must be simply stated, and that it may be answered it must be understood and the facts known. A category is an ultimate fact simply stated, but in order that it be accepted it must be understood and the person who understands it must have the necessary knowledge.

A category is something ultimately simple. The term *simple* is antithetic both to compound and to complex. That is reduced which is changed from a compound state to a simple state, and from a complex state to a simple state, and that is irreducible which can be no further simplified. To understand how compounds are reduced to simples we have to understand how bodies are reduced to particles. Having reduced bodies to their ultimate particles, a further reduction is possible, not by analysis but by abstraction; this ultimate reduction ends in discovering the irreducibles.

Historically the effort to accomplish this end was first vaguely made by considering the nature of language, when the simples which language expresses were called categories or predicaments. This was Aristotle's work. He makes them ten in number, namely: substance, quantity, quality, relation, place, time, position, possession, action, and passivity.

Of this list of categories Mill says:

> The imperfections of this classification are too obvious to require, and its merits are not sufficient to reward, a minute examination. It is a mere catalogue of the distinctions rudely marked out by the language of familiar life, with little or no attempt to penetrate, by philosophic analysis, to the rationale even of those common distinctions. Such an analysis, however superficially conducted, would have shown the enumeration to be both redundant and defective. Some objects are omitted, and others repeated several times under different heads. It is like a division of animals into men, quadrupeds, horses, asses, and ponies. That, for instance, could not be a very comprehensive view of the nature of Relation which could exclude action, passivity, and local situation from that category. The same observation applies to the categories Quando (or position in time) and Ubi (or position in space); while the distinction between the latter and Situs is merely verbal. The incongruity of erecting into a *summum genus* the class which forms the tenth category is manifest. On the other hand, the enumeration takes no notice of anything besides substance and attributes. In what category are we to place sensations, or any other feelings, and states of mind; as hope, joy, fear; sound, smell, taste; pain, pleasure; thought, judgment, conception, and the like? Probably all these would have

been placed by the Aristotelian school in the categories of *actio* and *passio*; and the relation of such of them as are active, to their objects, and of such of them as are passive, to their causes, would rightly be so placed; but the things themselves, the feelings or states of mind wrongly. Feelings, or states of consciousness, are assuredly to be counted among realities, but they cannot be reckoned either among substances or attributes.

This is why I call Aristotle the founder of materialism. He vaguely thought mind to be nothing but Ποιεῖν and Πάσχειν—*actio* and *passio*—nothing but action and reaction. In the same manner Spencer considers mind to be nothing but energy, while many of our modern physiological psychologists take the same ground, that mind is the action and reaction of forces.

The subject of the categories was considered by Kant; he makes them twelve, in four classes of three species, namely—

Singularity	Reality	Substance	Possibility
Plurality	Unreality	Dependence	Existence
Universality	Indefiniteness	Reaction	Necessity

This system has also been found defective. Kant believed the nature of mind to be insoluble,—to be the mysterious "noumenon,"—while he classified the faculties into intellections, emotions, and will, and then divided intellection into sensibility, understanding, and reasoning. This method of treating the subject led him into immeasurable absurdities which found expression in the statement that the mind can only reach antinomies or contradictions. That metaphysic known in modern times as idealism, which was founded by Berkeley, now affirms that the whole universe is the construction of mind which has no objective reality. Mind is the only reality. By this system mind is the single category, just as energy is the single category with Spencer.

Science considers the objective world and discovers the simples of which it is composed. These simples, these categories, these predicaments, are the irreducibles. Thus we have the irreducibles considered as predicaments from the standpoint of language, as categories from the standpoint of psychology, and as simples from the standpoint of objective science. All of these words have the same significance.

Now I shall attempt to derive a new set of categories from the standpoint of science.

How Bodies are Resolved into Particles

First I must set forth how bodies are reduced to particles.

Simples are made compound by incorporation through organization, for that which is incorporated is organized, and that which is organized is incorporated. Incorporation and organization are views of the same thing from different standpoints. We look at the thing from the standpoint of incorporation when we consider it as one thing, and we look at it from the standpoint of organization when we consider the many things of which it is composed, but the many are one and the one is many. Incorporation and organization are therefore postulates one of the other.

Particles are organized into bodies and every particle of the organized universe is incorporated in a hierarchy of bodies. When many are organized into one we consider the one as a body, but we consider the many severally as particles. When we speak of bodies we call their production incorporation, but when we speak of particles we call their production into bodies organization. Bodies are incorporated of particles; particles are organized into bodies.

Ultimate particles are found in nature to be organized into five grand classes, as taught by modern science. There are molecular bodies, star bodies, rock bodies, plant bodies, and animal bodies. The unorganized particles constitute the ether, and the artificial organization of men into bodies politic constitutes demotic bodies.

In astronomy the universe is reduced to stellar systems, and stellar systems to individual stars. In rocks, plants, and animals a reduction into simpler elements can be made by dissection, or with the microscope, but the ultimate reduction of all bodies to molecular particles is accomplished by chemical analysis.

Molecules are also reduced to simpler elements sometimes called atoms. All the bodies of the earth can be reduced to about seventy such elements, and many of them are found to exist in the stars. By chemical and physical research laws are found which lead chemists and physicists to believe that the so-called elements or atoms are themselves compound bodies. At the present time knowledge is limited in the direction of the minute as it is in the direction of the vast.

The ultimate simplicity of the particle stands upon the same experimental and logical foundation as does the ultimate system of the stellar universe.

The ultimate simplicity of atoms as particles has not been inductively established; but the multitudinous and diverse bodies of the world have been reduced to a very small number, and relations have been discovered that can be explained only upon the hypothesis of their reduction to unity by further analysis, just as astronomical research has not yet inductively discovered a completely unified system of stars. The unification of the stellar system and the unification of the molecular system stand upon the same inductive basis. The work has progressed in the direction of unification almost to the verge of the infinitesimal and the infinite, as these terms are used by science, and the facts already discovered in this borderland of research can be explained only by assuming ultimate unification — one kind of ultimate simple particle, one ultimate system of stars; thus both of these propositions have been deductively established.

I have stated in a brief manner how the bodies of the universe are reduced to particles by telescopic and microscopic resolution and by chemical analysis, and the progress which has been made in this work by resolving them inductively and experimentally into a very few, and that we have reason to believe they are compounded of one kind of ultimate particles, all organized into one ultimate stellar system. This is what I understand to be the monism of science.

The method of resolving bodies into particles I call *analysis*, and the proof of analysis is synthesis. I use the term analysis with a specific meaning, to distinguish it from abstraction. The proof of abstraction is concretizing.

How Concrete Objects are Resolved into Abstract Objects

Here I must first demonstrate that the abstract is always more simple than the concrete.

An object stands upon the table. I do not know what it is, and I first look at it and see its color in chiaroscuro, but I have learned how to interpret this color as a representative of form; this is the doctrine taught by modern psychology. I strike the object with my pencil, and discover the sound which it makes; I also interpret this sound as a mark of another element of its form, and I find that the object is hollow. I lift the object and find it is not heavy, and I further interpret this sensation and conclude that it is painted wood. I touch it and learn that it has a lacquered surface, and then smell it in examining the vapor which it exhales. Now I am ready to affirm that the object is a painted wooden bottle which has contained some odorous substance.

In this manner the concrete object is cognized by making a combination of its abstract attributes. Thus the humblest worm obtains all its knowledge of the objective world by combining abstractions. Every animal with the best developed organs of sense cognizes by abstracts, and then combines these abstracts to cognize concretes. Concretes are cognized by concreting abstracts. This is a universal law.

An ultimate particle can be resolved still further by abstraction. It is found that certain things are essential to it; that it cannot exist without these essentials, and that if one should be taken away the particle itself would be annihilated.

The ultimate particle must be an abstract unity. If the one could be resolved into many it would not be ultimate. If the one were annihilated the particle would be annihilated. Ultimate unity is essential to the existence of the ultimate particle.

The ultimate particle must be extended. If the extension were transmuted into unity, the particle would be annihilated; if unity were transmuted into extension, the particle would be annihilated. The unity and extension belong to the same particle. A unit without an extension is nothing; an extension without a unity is nothing; it must be one and extended.

The ultimate particle must have speed. Every particle of the universe known to man has motion. Every particle organized into a body must have the motion of that body, and every particle of organized matter exists in a hierarchy of bodies. The particle in the rock has its motion as heat, its motion in rotation on the earth's axis, its motion in revolution about the sun, and its motion in all the other bodies of the hierarchy. All bodies have motion and all particles of the ether have motion, but this motion is speed and path. The ultimate particle must have speed; we will consider its path hereafter. It is manifest that the speed of the particle cannot exist without the extension, and that the extension cannot exist without the speed anywhere in this universe. Speed is not extension, and extension is not speed. Speed cannot be transmuted into extension; extension cannot be transmuted into speed, but speed is essential to the particle.

Every particle must have persistence or continued existence, else the particle would be annihilated. The particle cannot come from nothing or go into nothing. The persistence cannot be transmuted into speed, nor can the speed be transmuted into persistence.

The particle must have not only unity, extension, and speed, but it must have persistence; persistence is therefore essential to the particle.

Every particle must have affinity if it exists in a body, for the particles of every natural body are held together by affinity, and no body of particles without affinity has yet been discovered. Affinity implies choice of association, and choice of association implies proto-consciousness, therefore every particle must have proto-consciousness as one of its essentials. Consciousness is not persistence, consciousness is not speed, consciousness is not extension, consciousness is not unity; but the particle has unity, extension, speed, persistence, and the proto-consciousness of affinity.

I have affirmed that every particle must have five essentials, but it must not be understood that they are possessions with which it can part. The particle is a unit, an extension, a speed, a persistence, and a proto-consciousness. Here is a squirrel playing under the tree by my window. It has a head, body, legs, and tail. It cannot part with its head, body, legs, and tail and still remain a squirrel. It cannot part with its metabolic organs, nor with its circulatory organs, nor with its muscular organs, nor with its reproductive organs, nor with its neural organs and still remain a squirrel; and if dissected it is but fragments of a squirrel undergoing dissolution because its organization is destroyed. But these are concrete parts of a squirrel that still remain as particles of matter after the squirrel has been disorganized, while the particle has abstract essentials to its existence with which it cannot part without annihilation. The ultimate particle does not depend on organization, but its essentials are inherent.

Every particle consists of five essentials. They are concomitant and cannot exist apart from one another. They are, as essentials, totally unlike one another and must therefore always be clearly distinguished. One essential cannot be derived from another. Unity cannot become extension, extension cannot become speed, speed cannot become persistence, persistence cannot become proto-consciousness; but one particle must be a unit, an extension, a speed, a persistence, and a proto-consciousness. As one body may be composed of many particles, so one particle is composed of many abstract essentials. The one is many and the many are one—many abstract essentials in one concrete particle.

Thus bodies are resolved into particles to get concrete simples, but the particles themselves may be further resolved into abstractions which I have here called essentials.

The ultimate particle in its essentials is absolute in that it does not depend on other particles for these essentials, but they inhere in itself without the aid of others. I shall therefore call these abstract essentials *absolutes*, and I shall define the term thus: An absolute is something which is independent of other things for its existence. It exists in itself. I use the term *thing* as the universal noun for all abstract or concrete objects, and I use the term *entity* for all concrete things only.

The pentalogic absolutes are concomitant in every particle; they cannot be taken from it, nor can a new absolute be added to it.

Thus I have demonstrated one pentalogic group of abstract simples as the absolutes of an ultimate particle of matter.

Relations

A relation must exist between two or more terms. The terms may be ultimate particles; but if one ultimate particle is related to another, then the five absolutes in one must be related to those of the other severally. The unity must be related to the unity, the extension to the extension, the speed to the speed, the persistence to the persistence, and the proto-consciousness to the proto-consciousness. A relation is a condition between two or more terms in respect to some connection between them.

Plurality.—One does not depend upon another for its unity, but the *one* may be an element in a plurality of *three*. The relation is that of likeness. It is taught in primary arithmetic that you cannot add unlike things. The three constitute a plurality. A plurality is thus a number of units related to one another in respect to some likeness.

There are many ultimate particles; neglecting the ether, all others are organized into bodies. There are many bodies, each constituting a unity of a plurality. Thus we have natural units of different orders, the plurality itself being an incorporated unit. The body is organized of a plurality incorporated in a unity. Unity is the absolute on which plurality is founded. Plurality is therefore the relative of unity.

Position. — Extension as an absolute has position for its relative. Position is the relation existing between two or more particles in respect to their mutual directions from one another and their mutual distances from one another. There is thus a double or polar direction from one particle to another, one being the opposite of the other, but the distance is the same. Considering the simplest relation of position as that which may exist between two particles, position is their mutual relation in respect to direction and distance.

Path. — Speed as an absolute in the ultimate particle has path as its relative, for the path is dependent upon others. It is taught in physics that any particle or body will have its motion directed in a straight line from which it will not deviate, nor will it increase or diminish its velocity unless it is interfered with by another particle or body. Two ultimate particles may interfere with each other by collision, when the path of both will be changed. In the case of the collision of bodies they will be mutually deflected, even to the extent of reversing the direction of molar motion, but neither one will increase nor diminish its speed, but all of the particles of both bodies will be deflected. Path, therefore, is the direction taken by an ultimate particle as determined by its collisions.

Change. — The persistence of an ultimate particle as an absolute has change as its relative, for it is dependent upon others. Change is a relation between terms. In this case the terms are persistence and the relations are changes. The relation of a change is a relation in respect to sequence, and the relation of sequence in ultimate particles is the relation of cause and effect, but in the simplest case there are two causes and two effects. Let us call cause and effect *causation ;* then causations are mutual in relations of causative sequence. Therefore change is a relation with respect to causation.

Choice. — Consciousness in the ultimate particle as an absolute has choice as a relative, for choice is the choice of others. Consciousness is awareness of self. Choice of one another in ultimate particles is affinity which implies proto-consciousness. The choice is always made for a purpose; therefore choice is the relation of selection for a purpose.

Remark: The will of all animal life can be resolved into the choice of ultimate particles.

Thus I have demonstrated a second pentalogic group of simples or categories.

The relations when reduced by abstraction to ultimate simplicity are found to be plurality, position, path, change, and choice. For every relative there is a corresponding absolute upon which it is founded. Unity is the foundation of plurality, extension is the foundation of position, speed is the foundation of path, persistence is the foundation of change, and consciousness is the foundation of choice.

Absolutes are Constant and Relations are Variable

The ultimate particles of the universe are constant, hence the essentials of these particles are constant; but these essentials are absolutes, hence all absolutes are constant.

The one of an ultimate particle remains one forever; it is constant. The ultimate units of the universe constitute a totality. This totality is broken up into many variable pluralities. Thus we have molecules of different orders, which are bodies of different orders, and some may be dissolved while others may be formed. Not only molecules but all other bodies may be constituted and destroyed, reconstituted and redestroyed to an infinite degree. Thus pluralities are variable.

The extension of every particle is the same and constant, but the position of every particle is variable, for severally they are in motion and the direction of these motions and their distances apart are forever changing; thus the position of every particle to others is variable.

The speed of every particle is the same and constant, but the path of every particle is variable from a straight line, for its path has components in every body in which the particle exists. The path of every particle is variable from a straight line, being in fact a vortex path.

Remark: That which we call acceleration of molar motion is wholly deflection of particles and is not acceleration of speed.

Notwithstanding the acceleration of molar motion appears to the eye as acceleration of molar speed, this is not true of the ultimate particles. The seen speed of a molar body may be made to begin, increase, diminish, and end by deflecting the unseen speed of its particles. A molar body lying upon the table may seem to be at rest, yet we know that it is in motion with the earth and with the solar system; in like manner we know that it has molecular motion, and these motions must all be deflected if it is given molar motion. If we call the motion of a particle of matter in its hierarchy of incorporations vortex motion, as it was called by Descartes, then molar motion may be given to a body by deflecting its vortex motion. Though I have elsewhere demonstrated that the speed of the particle is constant, I here show that it is a self-evident proposition. The persistence of every particle is the same and constant, while change is variable. This statement is self-evident.

Consciousness is constant, but choice is variable. This proposition has already been demonstrated.

Quantities

We have found that absolutes are constant and that relations are variable. On these absolutes and relations quantities are founded; every particle, whether ultimate or compound, has quantity. The quantities are number, which is unity and plurality; space, which is extension and position; motion, which is speed and path; time, which is persistence and change; and inference which is consciousness and choice, the inference being that a purpose will be subserved.

The space with which science deals must here be distinguished from the space of metaphysic. Science deals with a space composed of parts of extension, metaphysic deals with a space of void. The savage does not know of the existence of the atmosphere; he considers the floor of the earth to be domed with a firmament so as to constitute the tabernacle of the world—an unoccupied region, a void, a theater for animals and ghosts. We still retain the vestiges of this primeval doctrine when we consider space as void. Science does not proceed on the theory of void space, but of unconsidered space. Descartes banished such space from science.

Abstraction is a method of consideration. Metaphysic has a way of expressing the act of abstraction which yields an absurdity. Instead of saying that an attribute is selected for consideration, it says in effect that absolutes are taken from a concrete object until only the object remains to be considered; the object is then a nothing — a void.

Certain attributes of an object can be changed; thus the body that is cold may be made warm. But when the attributes of a body are resolved into categorical elements, one cannot be taken away without annihilating the object, nor can all attributes of a body be abstracted and leave anything to be considered.

Remark: Inferences of void space have never been verified, and thus become cognitions; but as these inferences are habitual and hereditary, the concept is not easily obliterated from the mind. The origin of the concept seems to come from savagery when the sky was considered as a firmament and the earth as the floor which inclosed a void space. This we now know is a pseudo-concept, yet it was confirmed by another when void minute spaces were conceived to exist. By the Greeks the ultimate particle was conceived to be round and rigid or hard, and the universe made up of round, hard particles would have interspaces. Now we must conceive that the ultimate particles are neither spherical nor rigid, but that they have extension, which may be deformed. Thus they may exist together in some other method of extension which may be deformed. Thus space is continuous without void. Yet there is another pseudo-concept which seems to mitigate against this doctrine when motion is considered as existing in void space. When space is considered as continuous, then motion must be considered as existing in continuous space. To clearly conceive this we must give an illustration:

A hollow cylinder may be conceived as being filled with smaller cylinders which touch one another without intervening voids; thus one cannot move without all moving. In the same manner we must conceive that the ultimate particles touch each other without intervening voids, but in order that one may move all must move with like and constant speed. One particle therefore cannot move unless all move. This conception harmonizes with the space of scientific teaching and also with the motion of scientific teaching.

Number is totally unlike space, space is totally unlike motion, motion is totally unlike time, and time is totally unlike inference. Every one is totally unlike every other one. Space cannot be transmuted into number, motion cannot be transmuted into space, time cannot be transmuted into motion, and inference cannot be transmuted into time. No one of these quantities can be transmuted into any other one; that is, they are wholly unlike one another and wholly underived one from another.

Thus we have demonstrated a third pentalogic group of simples or categories.

Properties

Particles constitute bodies, and we may consider them severally as particles or conjointly as bodies. From the standpoint of particles, quantities are involved; from the standpoint of bodies, properties are involved. Properties are founded on quantities, quantities are founded on relations, and relations are founded on absolutes.

Passing from the consideration of these particles to the consideration of bodies, number is considered as class, space is considered as form, motion is considered as force, time is considered as causation, and inference is considered as conception. This may be stated in another way: In the process of organizing particles into bodies, number becomes class, space becomes form, motion becomes force, time becomes causation, and inference becomes conception. Thus there is an objective reality corresponding to the subjective reality. The quantities still remain as quantities if we consider the particles, but the properties appear if we consider the bodies. For example, here are ten hollow cylinders or pipes, but they are organized into a gas stove. If we consider the pipes they are of cylindrical form, but the stove is not cylindrical. There are many attributes of the pipes which are not the same as the stove. Water is composed of oxygen and hydrogen, but there are attributes of water which are not found in oxygen and hydrogen severally. Vessels will float on water, but not on oxygen or hydrogen gas.

Number and class are reciprocal; space and form are reciprocal; motion and energy are reciprocal; time and causation are reciprocal, and, finally, inference and conception are reciprocal; that is, number in the particles becomes class in the organized body; motion in the particles becomes energy in the organized body;

time in the particles becomes causation in the organized body, and inference in the particles becomes conception in the organized body.

As absolutes are wholly unlike one another and cannot be derived one from another, and as relations are wholly unlike one another and cannot be derived one from another, and as quantities are wholly unlike one another and cannot be derived one from another, so properties are wholly unlike one another and cannot be derived one from another.

Thus we have demonstrated a fourth group of simples or categories.

Qualities

Particles and bodies inspire purposes when they are considered as good or evil. This gives rise to qualities. A quality is the good or evil of a property, quantity, or relation of a particle or body for a purpose had in view. Qualities are founded upon absolutes, relations, quantities, and properties, for these are necessary to qualities.

Qualities are grouped by purposes, and these are five-fold, viz., pleasure, welfare, morality, expression, and opinion.

All qualities are good or evil, and are thus antithetic or positive and negative. Thus pain is antithetic to pleasure, illfare is antithetic to welfare, morality is antithetic to immorality, expression has its antitheses in truth and error, while opinion has its antitheses in wisdom and folly.

These purposes give rise to five arts; they are esthetics, industries, institutions, languages, and instructions.

Pleasure, welfare, morality, truth, and wisdom are totally unlike one another, and they are totally underived one from another, yet they are concomitant in every effect on men and in every human act. There can be no pleasure or pain that is not also welfare or illfare. There can be no welfare or illfare that is not also moral or immoral. There can be no morality or immorality that is not also expressed as truth or error, and there can be no expression that is not also opinion as wisdom or folly.

Although these categories are disparate, yet they are interdependent. There is pleasure in welfare, pleasure in morality, pleasure in expression, and pleasure in opinion. There is welfare in pleasure, welfare in morality, welfare in expression, and welfare in opinion. There is morality in pleasure, morality in welfare, morality in expression, and morality in opinion. There is expression of pleasure, expression of welfare, expression of morality, and expression of opinion ; and finally there is opinion about pleasure, about welfare, about morality, and about expression. They are thus doubly concomitant.

Thus we have demonstrated a fifth group of simples or categories.

The categories which we have thus demonstrated are grouped as absolutes, relations, quantities, properties, and qualities. These rubrics we call *secondary categories*, and the categories into which they are resolved, *primary categories;* that is, there are five groups of secondary categories, every one composed of five primary categories.

Secondary categories constitute an ascending series. There can be no relations without absolutes; no quantities without relations and absolutes; no properties without quantities, relations, and absolutes; and no qualities without properties, quantities, relations, and absolutes. The series is ascended, for the upper is constituted of all the lower.

It will be found useful and important that we should give names to each group of the primary categories. Unity, plurality, number, class, and pleasure we shall call the unit categories. Extension, position, space, form, and welfare we shall call the extension categories. Speed, path, motion, force, and justice we shall call the speed categories. Persistence, change, time, causation, and expression we shall call the persistence categories. Consciousness, choice, inference, conception, and opinion we shall call the consciousness categories. Thus we have unit categories, extension categories, speed categories, persistence categories, and consciousness categories.

These categories are all unlike one another, and hence they are not classes. A class is founded upon likeness, and degrees of likeness make different classes, while categories are founded on unlikeness. Categories are abstractions ; classes are concrete things or entities. These are fundamental distinctions between class and category.

Classification is not abstraction. Berkeley was the first to set forth this doctrine, if my reading serves me well. The concept of a horse is not an abstraction, and the concept of any horse or all horses is not an abstraction. The concept of a class includes all of the class. The concept of vertebrates includes all of the vertebrates with all of their attributes. Every individual vertebrate animal has more attributes or marks than those which are common to all vertebrates, for it has its own peculiar marks which distinguish it from all other members of the class. This is true of every individual vertebrate, and the sum of the individuals which constitute the class have the sum of the characters which the individuals possess. Mammals, birds, reptiles, batrachians, and fishes are all vertebrates, but every such class has characters peculiar to itself which distinguish it from other groups. Yet one bird has all the characters which make it a bird and all the characters which make it an individual, and the class of birds have all the characters of the individual members of the class, and there does not exist any concrete being having only the attributes common to all birds.

The rule of formal logic that the intension of a class term is inversely proportional to its extension is invalid, because it is a pseudo abstraction. The mental act of generalization is totally distinct from the mental act of abstraction. What is valid is this: When we consider a kind in one of a series and discover an attribute in it, we expect to find that attribute in every other member of the series; or, knowing the attribute in one of the series, we seek to find it in the others, and only those attributes common to the series are considered as marks of the class.

Laws are applicable to classes of bodies inversely proportional to the extent of the class.

A bad habit of speech may result in a fallacy of thought. In the evolution of language this phenomenon is often found. Max Müller, in one of its manifestations, has called it a disease of language. Metaphysic has inherited this disease. The ancients thought categories to be distinct entities; that is, they reified categories, and it was very natural for them to speak of matter and energy as if they were separate existences; it was also natural for them to speak of mind and body as if they were separate existences, for they firmly believed in the ghost notion. This habit of speaking of mind and body, or of force and body, or of mind and force and body, or of matter and mind and force, was legitimate to the primitive mind. Of course we may still continue to speak of matter and mind, of matter and cause, of matter and force, of matter and form, or of matter and class; but he who really understands the nature of the categories in their concomitance will understand it as a faulty method of expression. It is a false method of expression to speak of a particle or body and one of its categories as if they were distinct entities.

Abstraction is not symbolism, with which it is sometimes confounded. A verbal symbol is a representative of a concept, while a concept is a subjective representative or symbol of an objective phenomenon, but the act of abstraction is totally different. Abstractions may be symbolized and concretes may be symbolized; particulars may be symbolized and generals may be symbolized; but we must properly distinguish between abstraction, symbolism, and generalization.

The Development of Attributes

Let us next consider the development of attributes by organization.

Attributes are evolved when particles become bodies. Thus particles of chlorine and particles of sodium become common salt, and salt has attributes additional to that of chlorine and sodium. The particles of common soda are sodium and carbon. Sodium is a white metal, and carbon is a gray graphite which, when crystallized, is the diamond. Thus the particles have their own attributes while the bodies have additional attributes.

The law may be stated thus: Particles in becoming bodies have additional attributes.

Now I wish to show how the abstracts which we call categories are developed when particles are organized into bodies.

Units.—Number is unity and plurality. When ultimate particles are organized into bodies, number becomes class, for a new class is constituted, while the unity becomes a kind and the plurality becomes a series of this kind. Or otherwise stated, the particles in number are all alike; hence they have no class, for a class involves likeness and difference, but a body is a class like other such bodies but different from its particles. Class begins with the incorporation of bodies from ultimate particles. When one class is organized with another, as molecules with molecules, by affinity, then class is organized with class and a third class is produced with additional attributes, and this process may continue to the limit of the organization of classes, and with every class formed new attributes will appear. Thus attributes of class are greatly multiplied. We may formulate this law:

I. As kinds are multiplied by organization, attributes are correspondingly multiplied.

Extension.—Let us again consider particles and bodies in respect to the organization of extension, which is the second absolute category. Space is extension and position. By organization space becomes form, because the extensions of the particles become the figure of the body while the positions of the particles become the structure of the body. Otherwise stated: The particles in space have no figure but their own, but the particles in the body have a new figure. The particles in space have no structure but their own, but the particles in the body have a new structure.

When forms have been produced they may be organized with other forms by gravity in an ascending series of compound forms, and with every such organization additional attributes will appear. Hence we may formulate the law:

II. As forms are multiplied by organization, attributes are correspondingly multiplied.

Speed.—Let us again consider bodies and particles in respect to the organization of speed, which is the third absolute. Motion is speed and path. By the organization of motion into force, speed becomes inertia or resistance to deflection, while path becomes velocity.

When a body is in motion in a straight line and another impinges upon it from the right or left, it is deflected; if the other body impinges upon it in the direction of that line from ahead it is turned back, or at least checked in its velocity proportional to its mass; if the impinging body strikes it from the rear, its velocity is increased. In all of these cases the change in the molecular motion of the body is the deflection of its particles. Here we must remember that the particles are deflected in all their components of path in vortex motion.

When forces have been produced, they may again be organized with other forces by pressure in an ascending series, and with every new force additional attributes will appear. Hence we may formulate the law:

III. When forces are multiplied by organization, attributes are correspondingly multiplied.

Persistence.—Let us now consider the same particles and bodies with respect to persistence, which is the fourth absolute category. The ultimate particle, which has persistence as an absolute, also has change as a relative. Persistence and change constitute time. When time is organized, it becomes causation, and the persistence becomes state and the state becomes event. When causation is organized with causation it becomes reproduction, while state becomes heredity and change becomes variation. Reproduction with heredity and variation are abstracts of the concrete known as parent and child. Causations may be partially organized when the parent becomes a number of offspring. This is fissiparous reproduction; but the complete organization of causations requires bisexual conjugation. Causation may be organized in an ascending series of bodies, and at every organization additional attributes will appear. We may formulate the law:

IV. When causations are multiplied by organization, attributes are correspondingly multiplied.

Consciousness.—Yet we have to consider the same particles and bodies from the standpoint of the fifth absolute.

When particles are organized into animate bodies, inference becomes conception, because consciousness becomes memory and choice becomes recollection. This is only primary conception. When concepts are organized with concepts, secondary concepts are developed and thus concepts are still further multiplied. Hence the law may be stated thus:

V. When concepts are multiplied by organization, attributes are correspondingly multiplied.

There is yet one more organization to be considered. This is a conventional organization of men or other animals into demotic bodies to accomplish purposes. By this method material bodies are not developed, but only ideal bodies. It has sometimes been called super-organization, but I shall call it *demotic organization.* It is but the continuation of the organization which begins with the forming of bodies from ultimate particles by affinity, but now it is the ideal organization of individuals into demotic bodies.

The fundamental demotic bodies exist in a hierarchy of units, so that every individual exists in an ascending series; for example, the man may exist in a township, and by reason of that he exists in a county, and by reason of that he exists in a state, and by reason of that he exists in the nation. But there are many ancillary societies to which he may belong. His ecclesiastical societies may be organized into a hierarchy of bodies. He may belong to various industrial organizations, to various organizations for pleasure, or, in fine, to any one or many of the organizations which men devise to accomplish their purposes.

Through every demotic organization attributes are multiplied. These attributes we call qualities. All qualities are good or evil and they depend upon the purposes entertained; thus purpose informs all the actions and activities of the universe.

When demotic bodies are organized, an entirely new class of concepts are evolved; they are concepts of qualities which are good or evil. They are properly grouped in five divisions as concepts of pleasure and pain, concepts of welfare and illfare, concepts of morality and immorality, concepts of truth and error, and concepts of wisdom and folly. This further multiplication of concepts gives rise to a vast multitude of attributes which must be considered as the most important factor in the totality of those we assign to bodies.

The Fundamental Classes of Bodies

The physical bodies of the universe are incorporated in an ascending series by discrete degrees of organization. A part of the ultimate particles of the universe is organized into molecules being integrated by affinity. Of the molecules that are incorporated, a part only remains in this condition without further organization. The larger part of these gases is contained in nebulæ. The study of nebulæ I shall denominate the science of *nephelonomy*.

Another part of the molecules is organized into stars, but the stars are composed of fluids in which the molecules are organized into forms. Forms do not appear in gases, but are first evolved in fluids and under gravity they assume the spheroidal form ; but the fluid portion of the stars is surrounded by a gaseous envelope. Stars are therefore both fluid and gaseous ; they are thus integrated by affinity and gravity, and differentiated as classes by chemism and into spheres by heat. Thus forms are organized of classes and these forms are again organized with classes that remain without form.

A still smaller part of the incorporated molecules are organized as forces in the planets and their satellites. Thus the planets have a higher organization than the stars. The planets are incorporated spheres with a fluid nucleus or centrosphere enveloped in a lithosphere, outside of which there is a hydrosphere and outside of this an atmosphere. The molecules of the planet are primarily integrated by affinity, further integrated by gravity, and still further integrated by lithifaction ; and they are differentiated by chemism, heat, and pressure. I call this science *geonomy;* but at the present time we can as a certitude speak only of the earth, though we may, with some show of reason, infer that the other planets of the solar system and other celestial spheres which are not stars have a like organization.

A still smaller part of the molecules are organized into plants. The bodies incorporated still require gas for their environment which they incorporate, they still require a fluid which they incorporate, and they still require solids which they incorporate. They have leaves which they spread in the air for the gas, and they have roots which gather the moisture and penetrate the solids ; and the plants themselves are gaseous, fluid, and solid. They develop a mode of motion which is called life. This is all accomplished by their organization of times into causations and of causations with causations to evolve reproduction. I call the science of these bodies *phytonomy.*

A still smaller part of the molecules of the universe are organized into animals. The bodies incorporated require for their organization plants in their environment which they devour; they require solids in their environment which they also devour; they require fluids in their environment which they drink, and they require gases in their environment which they breathe; and in the bodies themselves gases, fluids, solids, and plants are developed, and life is exhibited in their constitution. This organization is dependent upon the higher organization of mind, when concepts are organized from inferences and concepts are organized with concepts. I call the science of these bodies *zoönomy*.

There are five states of organized matter — gaseous, fluid, solid, vital, and mental. There are five systems of bodies that are organized out of these states of matter: they are molecules, the science of which is nephelonomy; stars, the science of which is astronomy; secondary celestial spheres, the science of which is geonomy; plants, the science of which is phytonomy; and animals, the science of which is zoönomy. In addition to this there are the ultimate particles exhibited in the ether, the science of which I call *ethronomy*, and there are ideally organized bodies, the science of which I call *demonomy*. Thus that which has been established by induction I have established by deduction. In the history of the development of science induction precedes deduction.

I have thus demonstrated that all natural and conventional or human organization is inspired by purpose. In this stage it is legitimate to inquire, What purpose?—to which the ready answer can be given, The betterment of condition. Until mind was organized in the animal world, this was accomplished by spontaneous choice on instantaneous occasion; but when mind was organized with memory, purpose was developed into design, or predetermined purpose. The purpose was betterment and the agency for betterment has always been coöperation.

Remark: The fundamental law of evolution is the law of affinity; but there are ancillary laws by which evolution is accelerated; the first was demonstrated by Laplace, though not named by him; it is the law of adaptation to environment. The second ancillary law was demonstrated in my volume entitled *The Geology of the Unita Mountains;* I named it "the instability of the heterogeneous." The third law was by Darwin, and it may be called the "survival of the fittest." The fourth law was demonstrated by Lamarck; it is the law of exercise. The fifth law was demonstrated by myself in 1883, and it is the law of culture. Thus evolution by affinity has been progressively accelerated.

Below are tabulated the twenty-five categories:

	Unit categories	Extension categories	Speed categories	Persistence categories	Consciousness categories
Absolutes........	Unity	Extension	Speed	Persistence	Consciousness
Relatives.........	Plurality	Position	Path	Change	Choice
Quantities........	Number	Space	Motion	Time	Inference
Properties........	Class	Form	Force	Causation	Conception
Qualities..........	Pleasure	Welfare	Morality	Truth	Wisdom

By a careful inspection of this table it will be seen that no one of the twenty-five attributes is like another, that no attribute in one column can be derived from an attribute in another column, but that the attributes in each column can be derived one from another in the order from above downward. Hence we may formulate the following laws or axioms for the categories:

Categorical Axioms

I. The unit categories are derived from unity.
II. The extension categories are derived from extension.
III. The speed categories are derived from speed.
IV. The persistence categories are derived from persistence.
V. The consciousness categories are derived from consciousness.
VI. One absolute cannot be derived from another of a different category.
VII. One relative cannot be derived from another of a different category.
VIII. One quantity cannot be derived from another of a different category.

IX. One property cannot be derived from another of a different category.

X. One quality cannot be derived from another of a different category.

We have already formulated the laws or axioms of the evolution of attributes, but will repeat them here.

Evolutional Axioms

I. As kinds are multiplied by organization, attributes are correspondingly multiplied.

II. As forms are multiplied by organization, attributes are correspondingly multiplied.

III. As forces are multiplied by organization, attributes are correspondingly multiplied.

IV. As causations are multiplied by organization, attributes are correspondingly multiplied.

V. As concepts are multiplied by organization, attributes are correspondingly multiplied.

In considering categories we must properly discriminate one from another. Unity must be discriminated from extension, extension must be discriminated from speed, speed must be discriminated from persistence, and persistence must be discriminated from consciousness. In like manner the five relatives must be discriminated, the five quantities must be discriminated, the five properties must be discriminated, and the five qualities must be discriminated. So also absolutes, relatives, quantities, properties, and qualities must be discriminated. The failure to make these discriminations is the source of many logical fallacies.

To avoid these fallacies the categorical axioms are given as the foundation of all deductive reasoning.